59TH CONGRESS, 1st Session. } SENATE. { DOCUMENT No. 65.

BLACK SANDS OF THE PACIFIC SLOPE.

LETTER

FROM

THE SECRETARY OF THE INTERIOR,

TRANSMITTING

COPY OF A LETTER FROM THE DIRECTOR OF THE GEOLOGICAL SURVEY FORWARDING REPORT PURSUANT TO RESOLUTION.

DECEMBER 12, 1905.—Referred to the Committee on the Geological Survey and ordered to be printed.

DEPARTMENT OF THE INTERIOR,
Washington, December 11, 1905.

SIR: I am in receipt of Senate resolution of the 7th instant:

That the Secretary of the Interior be, and he hereby is, directed to furnish to the Senate a report on the progress of the investigation of the black sands of the Pacific slope, authority for which was included in that section of the sundry civil act approved March 3, 1905, which provides for the preparation of the report on the mineral resources of the United States, and his opinion as to whether or not this investigation should be continued.

In response thereto I have the honor to transmit herewith a copy of a letter from the Director of the Geological Survey forwarding the report indicated in the above-mentioned resolution and to state that in my judgment the work of the investigation of the black sands of the Pacific slope should be continued and adequate appropriation made therefor.

Very respectfully,

E. A. HITCHCOCK,
Secretary.

THE PRESIDENT OF THE SENATE.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., December 9, 1905.

SIR: In response to the resolution of December 7, 1905, of the Fifty-ninth Congress, I have the honor to report that in the sundry

civil act approved March 3, 1905, providing for the preparation of the report on the mineral resources of the United States, the Geological Survey was directed to include an investigation of methods of extracting the mineral values of the black sands of the Pacific slope.

REASON FOR THE INVESTIGATION.

The immediate necessity for this investigation is due to the scarcity of platinum in the United States, occasioned by the Russo-Japanese war. It is not likely that this scarcity can be relieved without persistent investigation, covering considerable time, but it already appears probable that a supply of platinum sufficient for the needs of the United States can be developed in this country, and that the production of this valuable metal will not be limited merely to the Pacific coast.

METHODS USED.

In accordance with the act referred to, the Survey at once sent a circular (Exhibit A) to all the placer miners of the United States (about 8,000), inviting them to send to the Geological Survey samples of the heavy sands collected in placer gold mines. More than 1,000 such placer miners promptly responded with samples, which were at once assayed for gold and platinum. Further, these samples were scrutinized closely to detect the presence of various other minerals which have become industrially useful within the last five years. Among them are chromic iron ore, for the manufacture of paints; chrome steel and bichromate of potash; monazite and zircon, for the manufacture of incandescent gas and electric lights; magnetic iron ore, for the manufacture of steel, and especially tantalite and columbite, which have recently become very valuable in incandescent electric lighting.

RESULTS.

By reason of the prompt responses from the placer miners it was possible to examine sands from 34 States and Territories. It was quickly recognized that the distribution of valuable minerals in these sands is vastly greater than had previously been supposed. In addition to the useful minerals mentioned, considerable supplies were indicated of such valuable minerals as corundum, cinnabar (quicksilver ore), tin ore, garnet, and others. It was found that platinum occurs at many localities where its presence had not been suspected, and the majority of the specimens were found to contain gold in appreciable amount which it had been impossible to extract, either because the gold is very finely divided ("flour gold") or because it is coated with iron oxide or other materials which prevent amalgamation (rusty or black gold).

In order to determine whether these valuable minerals could be extracted at a profit, a number of concentrating machines of the best types were assembled at Portland, Oreg., for Portland proved the most central point for collecting the necessarily large quantities of these sands, and during the dry season, when the placer miners could not work, they could assemble at the exposition and note the results obtained. The Geological Survey retained Prof. Robert H. Richards,

dean of the mining school of the Massachusetts Institute of Technology and the principal authority on ore concentration, for a study of the extraction of these minerals.

It was quickly found that from 95 to 98 per cent of the gold and platinum could readily be extracted from the black sands simply by concentration on tables of the Wilfley, Pinder, Christonsen, and Woodbury types. It had been expected that the sand would require preparation for these tables by a special machine known as the hydraulic classifier, but this machine proved unnecessary, inasmuch as the sands of the sea beaches and the heavy sands from sluice boxes, from which the valuable ingredients, such as fine gold, rusty gold, and the useful minerals alluded to above, could not possibly be separated proved to be in the best condition possible for separation on tables. The railroad companies of the West cooperated by free transportation of many carloads of sands to the Survey's plant at Portland.

These concentration experiments attracted very much more attention than was expected from the placer miners. Concentrating tables had never been used in placer mining to any extent, but several hundred mines are now being equipped with machines of this character. Several thousand miners visited the concentrating work during the summer, and they were generally convinced that these methods would apply to some sands, but not necessarily to their own; therefore many of them asked and received permission to submit samples of their sands as soon as the rainy season would afford water for collecting them. As the minimum amount of sand necessary for such concentration was 100 pounds, and many of these mines are located from 50 to 100 miles from a railroad or even a wagon road, the miners went to much expense to collect samples. During September, and especially October and November, these samples were arriving much more rapidly than they could be examined. A detailed statement of the results thus far obtained in the investigation is shown in the accompanying printed reports, Exhibits B and C.

EXHAUSTION OF FUND.

The appropriation, designed to last till the close of the exposition in Portland, was made to last six weeks longer, and when exhausted, at the end of November, sands from more than 2,000 localities had been examined. Two preliminary reports were published. Copies of these have not only been sent to the mining companies interested, but have also been posted in every post-office in every county where placer mining is carried on. But sands from not more than one-third of the mining localities interested in this investigation had been examined at all, and there now remain at the plant more than 80 tons of samples, the investigation of which can not be completed without further appropriation. More than 600 localities are represented by these 80 tons of sand. Further, the placer miners of the West are sending in every day, at their own expense and without authorization from the Government, more samples than can be examined. This is due to the great desire to have the information on these sands available for the winter's mining.

UTILIZATION OF BY-PRODUCTS.

It was found in the course of the examination that much larger supplies of high-grade magnetic iron ore could easily be made valuable

by concentration of this character from the sands of the Pacific coast beaches and from waste magnetic iron ore from the sluice boxes of placer mines. This addition of wealth would be great if suitable means for smelting these sands could be found, notwithstanding the high prices of fuel on the west coast and the prejudice against these sands on account of their finely divided character. On the other hand, the abundance of water power on the coast has developed electric power at very low rates at many points. To determine whether electric smelting of these ores is practical or not advantage was taken of a recent comprehensive report by the Canadian government. With the cooperation of the Portland Chamber of Commerce an electric smelter was built from materials obtained principally on the spot, and steel of good quality was made directly from the ore, with as high an efficiency as 18 pounds of steel per horsepower-day, an efficiency equal to the best electric-smelting practice in foreign countries where such processes have become established.

NECESSITY OF EXTENDING THE WORK.

Thus it appears to be extremely desirable not to interrupt this valuable investigation during the present winter. There is little doubt that it will lead, within two years, to an addition of from two to five millions of dollars to the output of the placer gold mines of the West, in addition to an adequate supply of platinum and the allied metals, osmium and iridium, and to the development of valuable industries at many points in the West to handle the by-products which this examination shows to be present in these sands. This addition to the wealth of the country will be distributed over every State and Territory west of the Missouri River, and will be equally valuable to the placer mines of the Southern Appalachian States, and to many undeveloped placer regions in Wisconsin, Minnesota, and other lake States.

At this date the plant is idle, but is kept in readiness, so that it can be started at a day's notice. The least appropriation for which this work can be carried on from the present time till the 1st of June will be $25,000. If this plant is abandoned and its location changed, the estimated cost of reestablishing the plant next summer would be an additional $8,000, which would be saved by work during this winter.

I therefore earnestly recommend that suitable legislation be promptly enacted to provide $25,000 for the continuance of this work.

The following reports are appended:

Exhibit A.—Circular sent to the placer miners.

Exhibit B.—First preliminary report of progress.

Exhibit C.—Second preliminary report of progress.

Exhibit D.—Statement of the property acquired by the Geological Survey which is available for continuing this investigation. It includes a fully equipped assay laboratory besides the concentration apparatus given in detail.

Exhibit E.—A statement of the expenditures which have been made in this work.

Very respectfully, CHAS. D. WALCOTT,
Director.

The SECRETARY OF THE INTERIOR.

EXHIBIT A.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., March 21, 1905.

DEAR SIR: Within the last few years much inquiry has been made concerning various minerals occurring in the heavy sands (so called "black sands") which collect in the riffles in placer mining. The Geological Survey has therefore undertaken an exhaustive examination of all the minerals contained in the placer deposits of the United States.

It is proposed to collect the heavy sands from all placer mines in the United States where evidence of platinum has been found by preliminary tests. The samples thus obtained will be used in determining the best methods of extracting the various minerals which have economic value. It is hoped that, in many places, the separation and sale of these useful minerals, such as magnetite, chromite, garnet, monazite, rutile, topaz, zircon, gold, platinum, iridosmine, etc., will become a permanent and profitable industry.

As a preliminary step in this investigation, you are cordially invited to mail to this office, using the accompanying tag, which requires no postage, not more than four pounds of material most likely to contain platinum in your placer deposit. This material will be carefully examined, and you will be duly notified of the results. It is suggested that you concentrate the gravel as well as you can before mailing it, care being taken not to lose any heavy material. You should carefully note on the package, or in a letter accompanying it, or both, the total quantity of original gravel which your concentrate represents, in order that a general idea may be obtained of the value of your gravel for the purposes under investigation.

After an examination of these preliminary samples, experts will be sent to all localities where preliminary tests give promise of any useful mineral in profitable quantity. The expert will report on the size of the deposit and superintend the collection of representative samples for concentration.

Concentration experiments will probably be carried out in connection with the exhibits of mining machinery at the Lewis and Clark Centennial at Portland, Oreg., between June 1 and October 15 of this year.

I shall appreciate all information which you can give as to any efforts previously made to separate platinum from your sand, or from other sands in your neighborhood, and as to the quantity of platinum produced in your district. Each package of sand should be accompanied by exact information as to the name and post-office address of the sender, the name of the mine or claim from which it came, and the State, county, city, village, or district in which the deposit is located.

On account of the increased demand for platinum, it is the intention of this office to examine also the localities where experience has made it probable that platinum ores may profitably be looked for in place. The inclosed tags can therefore be used also for sending in specimens of ores likely to contain platinum and associated metals.

Great care should be used to pack the sand securely for transmission through the mails. It is preferable to sew up the sand tightly in a canvas bag, and tie the tag, which requires no postage, carefully to the package. The sand should be dry when mailed.

On request, additional postal franks will be sent to you.

No specimens will be examined unless the above information is given in regard to the exact locality from which the samples have been obtained.

The accompanying information in regard to platinum may be of interest to prospectors.

Very respectfully,

CHARLES D. WALCOTT, *Director.*

PROPERTIES OF PLATINUM.

Pure platinum is a silvery white metal with a specific gravity of 21.5. It is the heaviest metal occurring in nature with the exception of iridosmium. It is almost as hard as iron and very malleable. Platinum does not amalgamate with quicksilver, is not dissolved by potassium cyanide when cold, is not attacked by acids, except the mixture of nitric acid and hydrochloric acid, known as aqua regia. It is more difficult to melt than gold.

Native platinum has been found most frequently in gold-bearing sands. On account of its weight it remains in the sluices with gold and other heavy material.

Platinum is most readily distinguished as follows: (1) By its great weight—in panning it remains behind even gold in the pan; (2) its white color—it is whiter than lead and is distinguished from amalgam by its smooth surface, whereas the surface of amalgam, as seen under a good glass, is rough; (3) its resistance to nitric acid, as compared with native silver or lead.

Native platinum is usually very impure; occasionally it contains so much iron, chromite, and other impurities as to be dark in color and not easily distinguished from grains of chromite, with which it is very frequently associated. It often contains iridosmine, which occurs as flat, angular scales, while platinum grains are usually rounded like gold dust. Generally platinum grains are smaller than gold grains. Large nuggets are very rare.

DISTRIBUTION OF PLATINUM.

Platinum has been found in America in the following localities:

Locality.	County.	Value of platinum per ton of concentrated sands.	Value of platinum contained for each dollar in gold.	Remarks.
CALIFORNIA.				
Chico	Butte	$5.46	$0.08	
Magalia	do	.30	.01	
Oroville	do			Found frequently in dredging operations.
Mokelumne Hill	Calaveras	.02	.002	
Crescent City	Del Norte	.04	.17	
Smith River	do	.54	.07	
South Fork Smith River	do	618.31	.02	
Wilson Creek	Humboldt	.02	.08	
Stone Lagoon (beach)	do			Has yielded platinum in commercially appreciable quantity.
China Flat	do	177.08	1.38	
Orleans	do	6.87	.50	
Gold Bluff beach north of Arcata	do			Platinum is very fine grained.
Little River beach	Mendocino			Has yielded platinum.
Michigan Bluff	Placer	.34	.01	
Genesee	Plumas	.06	Trace.	
Beach	San Luis Obispo			Promising locality.
Santa Barbara beach	Santa Barbara			Do.
Lompoc beach	do			Do.
Santa Cruz beach	Santa Cruz			Very fine grains.
Bee Gum district	Shasta			Promising district.
Sawyers Bar	Siskiyou	2.30	.31	
Oak Bar	do	.54	.12	
Fort Jones	do	.07	.001	
Klamath River	do	2.40	.51	
Rock Ranch	do	.51	.26	
Callahan	do	7.02	1.34	
Hornbrook	do	.18	.06	
Happy Camp	do	50.97	1.48	
Cecilville	do	2.01	.14	
Beegum	Tehama			Do.
Trinity Center	Trinity	.28	.79	
Burnt Ranch	do	13.09	1.04	
Big Bar	do	3.75	.11	
Junction City	do	1,934.18		
North Fork	do			Plentiful.
Hawkins Bar	do	4.05	.34	
Hay Fork district	do			Platinum contains much iridosmium.
Camptonville	Yuba	.32	.04	
OREGON.				
Denmark	Curry	.15	.18	(Average.)
Pistol River beach	do	.06	.08	
Port Orford	Coos			Yielded in commercial quantity.
Mouth of Rogue River	Curry			Very promising.
Yaquina beach	Lincoln			Sands inferior.
Near Grants Pass	Josephine			Reported.
Kerby	do			Plentiful.
Waldo	do			Promising locality.

Locality.	County.	Value of platinum per ton of concentrated sands.	Value of platinum contained for each dollar in gold.	Remarks.
IDAHO.				
Snake River from Bakersville to Lewiston.	Nez Perces.....	.....	.....	Platinum occasionally found.
MONTANA.				
Miles City.....	Custer	.....	.....	Reported.
NEW YORK.				
Plattsburg	Clinton.....	.....	.....	One nugget found in 1880.
NORTH CAROLINA.				
.....	Rutherford.....	.....	.....	One nugget found in 1847.
GEORGIA.				
.....	Lumpkin.....	.....	.....	Reported.
PENNSYLVANIA.				
.....	Lancaster	.....	.....	Platinum detected in 1852.
Sassamansville.....	Montgomery	.....	.....	Detected, but no quantity.
WYOMING.				
Rambler mine, Rambler district.	Albany	.....	.....	Platinum (and probably palladium as arsenide) in place, and obtained from copper matte.
ALASKA.				
Beach north of Lituya Bay...	.....	.....	.....	Reported.
CANADA.				
Eastern townships of Quebec .	St. Lawrence River	.....	.....	Discovered middle of last century.
Rivière des Plantes	Beauce district, Quebec.	.....	.....	Few minute scales discovered.
Rivière du Loup	Bonaventure	.....	.....	Do.
Sudbury.....	Ontario.....	.....	.....	In place, as arsenide. Richest platinum producer in Canada.
Similkameen River. Tulameen River, Granite Creek, Valley of Slate Creek.	British Columbia.	.....	.....	Prospecting being carried on. $383,000 accredited 1885–1888.
Caribou district.....	.....do	.....	.....	Reported.
Fraser Canyon, near Yale	.....do	.....	.....	Dredging operations begun.
MEXICO.				
Las Yedras mine.....	Sinaloa	.....	.....	Reported.
CENTRAL AMERICA.				
Cholotea	Honduras	.....	.....	Reported.
Gracias	.....do	.....	.....	Do.
WEST INDIES.				
Yaqui River.....	Santo Domingo...	.....	.....	Platinum grains discovered.
SOUTH AMERICA.				
Minas Geraes (Rio das Velhas).	Brazil	.....	.....	Well-known locality.
Boa Esperanea.....	.....do	.....	.....	Reported.
Congo Seco.....	.....do	.....	.....	Do.
Aicoupai, on Hamelin Creek..	French Guiana...	.....	.....	Nugget found in 1861.
Cartagena.....	Colombia.....	.....	.....	Discovered in 1735.
El Choco district (Atrato and San Juan provinces).	.....do	.....	.....	Principal South American productive district.

Exhibit B.

Black Sands of the Placer Mines of the United States.

[By David T. Day.]

INTRODUCTION.

The last Congress authorized an investigation of the values contained in the black sands of the placer mines of the United States, to be made under the supervision of the Director of the United States Geological Survey. The details of the investigation up to the present time are given in the present report.

As a preliminary the following circular letter was sent to all the placer miners known in the United States, about 8,000 in number:

Department of the Interior,
United States Geological Survey,
Washington, D. C., March 21, 1905.

Dear Sir: Within the last few years much inquiry has been made concerning various minerals occurring in the heavy sands (so-called "black sands") which collect in the riffles in placer mining. The Geological Survey has therefore undertaken an exhaustive examination of all the minerals contained in the placer deposits of the United States.

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LABORATORY WORK.

SAMPLES RECEIVED.

From the miners addressed, 828 samples of black sand have thus far been received for investigation. These samples come from the following States and Territories, and from British Columbia, Central America, and Mexico:

Alabama.	Iowa.	Oklahoma Territory.
Alaska.	Kansas.	Oregon.
Arizona.	Mexico.	Pennsylvania.
British Columbia.	Mississippi.	South Dakota.
California.	Missouri.	Texas.
Central America.	Montana.	Utah.
Colorado.	Nebraska.	Vermont.
Cuba.	Nevada.	Washington.
Georgia.	New Mexico.	West Virginia.
Idaho.	New York.	Wisconsin.
Indian Territory.	North Carolina.	Wyoming.
Indiana.	Ohio.	

This shows more general interest in the matter of obtaining additional useful values from black sands than had been anticipated.

ASSAYS FOR GOLD AND PLATINUM.

Of the samples received, 195 specimens have been assayed for their contents of gold and platinum, with the result that platinum has been found in samples from the following localities:

Gold and platinum contained in black-sand concentrates from various placer-mining districts, by States and counties.

Number of sample.	State and county.	District.	Ounces per ton of concentrate.	
			Gold.	Platinum.
	ARIZONA.			
D 5007 No. 2	Yavapai	Columbia	0.79	0.06
D 5010	do	Granite Creek	Trace.	Trace.
D 5008	do	Walnut Grove	Trace.	Trace.
	CALIFORNIA.			
D	Butte	Oroville	19.94	27.45
D 8	do	Alvarado placer mine, Butte Creek	5.22	.17
D 26	do	Buchanan Hill	1.09	.08

Gold and platinum contained in black-sand concentrates from various placer-mining districts, by States and counties.—Continued.

Number of sample.	State and county.	District.	Ounces per ton of concentrate.	
			Gold.	Platinum.
	CALIFORNIA—con.			
D 29	Butte	Peavine Creek	7.03	0.83
D 30	do	Empire	.08	Trace.
D 16	Calaveras	Wild Goose mine	39.08	.35
D 34	Humboldt	Orleans	19.00	4.00
D 9	Mendocino	T. 16 N., R. 12 W., sec. 7	Trace.	Trace.
D 19	Nevada	Rough and Ready Township	5.60	.52
D 2	Placer	Taylor mine, North Fork American River, Colfax.	29.26	1.27
D 1	do	Southwest of Auburn	24.14	1.48
D 6	Placer	Gold Run	37.61	8.78
D 11	do	Gold Blossom mine, Butcher Ranch mining district.	191.60	3.36
D 23	do	American River	126.9	9.67
D 15	Plumas	Nelson Creek	1.45	.12
D 21	do	Bowlder Nest mine on Grizzly Creek, Genesee district.	1.44	.66
D 32	do	Rock Island Hill mine	10.80	.16
D 40	do	Little Grizzly mine	Trace.	Trace.
D 47 No. 1	do	La Porte	2.98	.21
D 38	San Bernardino	Van Dusen Canyon, Holcomb	.12	.06
D 5	Shasta	Sacramento River, north of Redding, Gem mine.	.64	.28
D 14	do	Gypsy mine, Shasta district	8.29	.25
D 18	Siskiyou	Fox Creek	.72	Trace.
D 22	do	Grouse Creek	10.31	.18
D 36	do	Happy Camp district	None.	.82
D 20	Trinity	Junction City mining district	28.43	25.80
D 33	do	South Fork and Trinity River	9.02	1.28
D 35	do	T. 5 N., R. 7 E.	4.90	4.61
	COLORADO.			
D 6037	Chaffee	Buena Vista	1.99	.43
D 6033	Costilla	San Luis Valley	None.	Trace.
D 6043	Pitkin	Junction of Gunnison, Chaffee, and Pitkin counties.	.05	.05
D 6029	Saguache	Pole Creek, Cretone	.34	.06
D 6006	San Miguel	West of Telluride	.37	.09
D 6016	do	Saw Pit	Trace.	Trace.
	IDAHO.			
D 4012	Bingham	West of Blackfoot	19 62	.18
D 4021	do	West bank Snake River	1.60	.70
D 4009	Boise	Ox Bow tunnel, Payette River	.52	.28
D 4014	do	Gold Fork, North Payette River	2.02	.08
D 4010	Elmore	Bear Creek mining district, Rocky Bar	1.10	.11
D 4029	do	Baker Gulch, Crooked River	Trace.	Trace
D 4017	Fremont	Gem Placer mine, Menan	Trace.	Trace.
D 4034	Idaho	Elk City district	1.06	.05
D 4023	Shoshone	Pierce City	.16	.04
D 4030	do	Big Island, North Fork Clearwater River.	.16	.08
D 4031	do	Beaver Butte mining district, Trail Creek.	6.40	Trace.
	MONTANA.			
D 1004	Granite	Princeton	1.67	.05
	NEW MEXICO.			
D 9006	Santa Fe	Los Cerrillos	Trace.	Trace.
D 9008	Lincoln	Tecolote Mountains	Trace.	Trace.
	OREGON.			
D 2002	Baker	South of Durkee	9.90	.22
D 2009, No. 1	Coos	Old Ocean Beach, Randolph mining district.	1.8	2.10
D 2009, No. 2	do	do	None.	.91
D 2009, No. 3	do	do	.02	.10
D 2045	do	Ocean Beach, Whiskey River	None.	.20
D 2010	do	Ocean Beach	1.25	6.23
D 2003	Douglas	East of Riddle	4.71	8.59
D 2006	do	Co Creek mining district, Glendale	.50	2.25
D 2023	do	Riddle	19.27	128.73

Gold and platinum contained in black-sand concentrates from various placer-mining districts, by States and counties—Continued.

Number of sample.	State and county.	District.	Ounces per ton of concentrate.	
			Gold.	Platinum.
	OREGON—cont'd.			
D 2028	Douglas	North Fork Steamboat River	0.18	0.02
D 2028, No. 2	do	Bohemian mining district	Trace.	Trace.
D 2014a	Josephine	Fry Gulch mine	1.88	4.53
D 2021	do	Galice Creek	None.	.26
D 2029	do	Sucker Creek	6.53	.67
D 2030	do	Allen Gulch mine, Waldo	37.30	.58
D 2013	do	Coyote Creek	None.	Trace.
D 2025	Linn	South Santiam River	2.60	3.52
D 2001	Union	Camp Carson district, Grande Ronde River	2.40	.12
	SOUTH DAKOTA.			
D 9504	Custer	French Creek	Trace.	Trace.
	UTAH.			
D 15516	Garfield	Colorado River	6.36	.15
D 15511	Morgan	North of Morgan	Trace.	Trace.

EXAMINATION FOR OTHER MINERALS.

In addition to the foregoing, 190 samples have been examined to date as to the minerals which they contain. Among the many interesting results the existence of columbite, tantalite, and other tantalum minerals has been shown in Nez Perces County, Idaho.

The following mineral occurrences other than gold and platinum noted in the progress of this investigation and presented here by States and counties are of interest:

Arizona:

Pinal County—Magnetite, ilmenite, epidote, zircon, topaz, scheelite, hematite, and pyrite.

Yavapai County—Hematite, magnetite, garnet, diorite, ilmenite, epidote, tourmaline, pyrite, pseudomorphs, zircon, monozite, and apatite.

California:

Butte County—Zircon, rutile, chromite, molybdenite, magnetite, hematite, ilmenite, cinnabar, metallic copper, pyrite, actinolite, epidote, biotite, and tremolite.

Calaveras County—Psilomelane, magnetite, hematite, pyrite, epidote, zircon, garnet, ilmenite, and rutile.

Eldorado County—Pyrite, metallic copper scales, magnetite, ilmenite, garnet, epidote, zircon, and monazite.

Humboldt County—Magnetite, hematite, ilmenite, pyrite, cinnabar, chromite, garnet, epidote, and zircon.

Nevada County—Chromite, magnetite, pyrite, hematite, ilmenite, zircon, siderite, and epidote.

Placer County—Magnetite, chromite, pyrite, ilmenite, zircon, epidote, and garnet.

Plumas County—Magnetite, ilmenite, quartz with biotite, zircon, pyrite, garnet, epidote, pyroxene, and chromite.

San Bernardino County—Magnetite, hematite, zircon, garnet, epidote.

San Francisco County—Pyrite and metallic copper scales.

Shasta County—Magnetite, chromite, epidote, pyroxide, pyrite, zircon, and ilmenite.

Siskiyou County—Magnetite, hematite, pyrite, ilmenite, chromite, zircon, tremolite, rutile, and epidote.

Trinity County—Magnetite, hematite, chromite, manganese, zircon, ilmenite, and cinnabar.

Tuolumne County—Magnetite, rutile, and ilmenite.

Yuba County—Magnetite, ilmenite, hemaitte, chromite, manganese, and zircon.

Colorado:
- Chaffee County—Magnetite, hematite, and zircon.
- Costilla County—Magnetite, chromite, ilmenite, monazite, and zircon.
- Jefferson County—Magnetite, garnet, hematite, ilmenite, epidote, and zircon.
- Pitkin County—Galena.
- Summit County—Magnetite, ilmenite, hematite, hübnerite, garnet, limonite, and epidote.

Idaho:
- Ada County—Magnetite, ilmenite, and garnet.
- Bannock County—Magnetite, ilmenite, chromite, zircon, monazite, hematite, and manganese.
- Bingham County—Magnetite, ilmenite, zircon, and green pyroxene.
- Boise County—Magnetite, garnet, chromite, ilmenite, epidote, monazite, zircon, rutile, and hematite.
- Elmore County—Magnetite, hematite, ilmenite, garnet, and zircon.
- Fremont County—Magnetite.
- Idaho County—Ilmenite, monazite, polycrase, rutile, magnetite, titanite, garnet, zircon, hematite, pyrite, pseudomorphs, epidote, and cyanite.
- Latah County—Magnetite, garnet, monazite, hematite, and pyrite.
- Lemhi County—Monazite, rutile, hematite, ilmenite, magnetite, zircon, and epidote.
- Nez Perces County—Rutile, magnetite, tourmaline, epidote, ilmenite, and monazite.
- Payette River County—Monazite, magnetite, ilmenite, garnet, epidote, and zircon.
- Shoshone County—Magnetite, hematite, pyrite, garnet, oxidized pyrite, ilmenite, monazite, zircon, rutile, columbite, tantalum, cinnabar, and titanite.

Kansas:
- Marshall County—Manganese ore, garnet, and quartz.

Montana:
- Granite County—Magnetite, ilmenite, monazite, epidote, wolframite, garnet, and zircon.
- Madison County—Hematite, magnetite, garnet, and monazite.
- Missoula County—Magnetite, pyrite, hematite, chromite, and garnet.

New Mexico:
- Bernalillo County—Magnetite, ilmenite, pyroxene, hematite, garnet, zircon, biotite, and epidote.
- Sandoval County—Magnetite, ilmenite, hematite, biotite, rutile, pyrite, epidote, and zircon.
- Santa Fe County—Magnetite, hematite, ilmenite, epidote, garnet, and zircon.
- Sierra County—Magnetite, ilmenite, garnet, monazite, zircon, and rutile.

Oregon:
- Baker County—Magnetite, pyrite, limonite, chromite, garnet, zircon, cassiterite, and biotite.
- Clackamas County—Magnetite, hematite, epidote, and ilmenite.
- Coos County—Magnetite, chromite, garnet, zircon, monazite, ilmenite, titanite, and epidote.
- Douglas County—Magnetite, hematite, chromite, garnet, ilmenite, zircon, and epidote.
- Jackson County—Magnetite, chromite, ilmenite, pyrite, rutile, monazite, epidote, zircon, garnet, and hematite.
- Josephine County—Magnetite, chromite, zircon, ilmenite, rutile, monazite, pyroxene, and scheelite.
- Lane County—Magnetite, copper ore, hematite, biotite, and chalcopyrite.
- Tillamook County—Magnetite, ilmenite, garnet, pyroxene, chromite, and zircon.
- Union County—Magnetite, ilmenite, biotite, zircon, and titanite.

South Dakota:
- Custer County—Garnet, ilmenite, rutile, and epidote.
- Lawrence County—Monazite, magnetite, hematite, chromite, and ilmenite.
- Pennington County—Hematite, copper ore, magnetite, garnet, epidote, and pyrite.

Utah:
- Boxelder County—Arsenopyrite and pyrite.
- Garfield County—Hematite, magnetite, ilmenite, garnet, zircon, and monazite.
- Morgan County—Magnetite, ilmenite, biotite, pyrite, epidote, hematite, and zircon.
- Weber County—Hematite, magnetite, ilmenite, garnet, and zircon.

Washington:
Clarke County—Hematite and magnetite.
King County—Magnetite, hematite, and chromite.
Kittitas County—Garnet, hematite, pyrite, magnetite, and epidote.
Okanogan County—Magnetite, hematite, ilmenite, garnet, zircon, epidote, and biotite.
Stevens County—Magnetite, ilmenite, garnet, monazite, epidote, zircon, rutile, and pyrite.
Wyoming:
Fremont County—Magnetite, hematite, epidote, garnet, zircon, and ilmenite.

FIELD WORK.

During June and July investigations of various placer deposits were carried on. A preliminary examination of the occurrence of heavy sands at the mouth of the Columbia River, in Oregon, and on the Washington shore, was made by Doctor Day, who also examined the material pumped up by the dredge which the United States Engineer Corps has in operation at Pillar Rock, near the mouth of Columbia River. Mr. A. H. Gale, assisted by Mr. Earl W. Bachert, was detailed to make a careful examination of these localities in cooperation with the Astoria Chamber of Commerce, which paid the expense of collecting the sands. Five carloads were taken from Clatsop Plains, Seaside, Hammond Station, Warrenton, and the dredge at Pillar Rock. These were sent to the concentrating pavilion at Portland for practical tests.

Doctor Day also examined the black sands which occur in the large bar of Columbia River opposite Hood River, Oregon. A carload of sand was collected here and is now being further investigated by Mr. J. F. Batchelder.

After an investigation of the sands at the mouth of the Columbia River, Mr. Gale joined Prof. J. F. Kemp at Grants Pass, Oreg., and aided him in the examination of the heavy sands found with the placer mines at Leland, Wolf Creek, Grants Pass, the Champlin dredge south of Grants Pass, Kirby, Waldo, Smith River, the mouth of Pistol River, the mouth of Rogue River, Gold Beach, Bandon, Marshfield, and Ophir, Oreg., and at Redding, Shelley Creek, the ocean beach at Crescent City, and Oroville, Cal. Professor Kemp, assisted by Mr. Victor C. Heikes, is now engaged in a similar examination of placer sands on the Snake River in Idaho.

Other beach sands were examined by Mr. W. T. Schaller at San Diego, Lompoc, Aptos Beach, San Luis Obispo, and in the neighborhood of San Francisco, Cal.

Mr. H. E. Crain, of Cheyenne, Wyo., has been detailed to collect samples from the mines in the neighborhood of Rambler, Wyo., which has already been examined by the Geological Survey for platinum. The object of collecting these large-scale specimens from the Rambler region is for the purpose of determining the nature of the minerals containing platinum at that place.

Dr. Joseph Hyde Pratt is investigating the placers of the Yellowstone River near Miles City and Helena, Mont.

WORK AT LEWIS AND CLARK EXPOSITION.

CONCENTRATION EXPERIMENTS.

Machinery.—By courtesy of the Lewis and Clark Exposition Company a pavilion 100 feet long by 50 feet wide, adjoining the mines building, has been provided for the installation of concentrating machinery to carry on full-scale experiments as to the best methods of separating the useful minerals in the various specimens of sands collected. Prof. Robert H. Richards, of the Massachusetts Institute of Technology, is in charge of the experiments.

Invitations to send full-sized concentrating machines to the exposition for testing these sands were sent out several months ago to all manufacturers of concentrating machinery in the United States. As a result of this correspondence the following machines have been installed:

The Mine and Smelter Supply Company, of Denver, Colo., erected at its own expense a full-sized Wilfley concentrator, and detailed Mr. A. W. Park to carry out any and all experiments in the concentration of sands that the Geological Survey might direct.

The Joshua Hendy Machine Works, of San Francisco, Cal., installed the Pinder concentrator, which is under the personal direction of Capt. J. W. Pinder, the inventor. This company has also a Hendy Challenge ore feeder, which is in charge of Messrs. J. Lee Anderson and Spencer Thompson.

The Woodbury concentrating table has been installed and is operated by the inventor, Mr. George E. Woodbury, of San Francisco, Cal.

Mr. C. Christonsen, of Oretown, Oreg., installed a Christonsen concentrator, and is operating it himself, with Mr. Charles D. Walcott, jr., as assistant.

A new style of ore muller has been installed, and is operated by the inventor, Mr. I. J. Merrill.

A Wetherill magnetic seperator, type E, of full size, has been loaned by the Wetherill Magnetic Seperator Company, of New York. This machine is arranged to make separation of minerals at greater or less magnetic strength, ranging from that furnished by a current of 0.02 amperes to that furnished by a current of 3.5 amperes. This is under the direction of Mr. Harmon V. Morse, of Johns Hopkins University.

Placed next to the magnetic separator is a set of the well-known Imperial ore screens, loaned by Mr. John Traylor, of Denver, Colo., and operated under the supervision of Mr. A. W. Park, assisted by Mr. Clifford L. Gardiner.

In process of erection are two hydraulic classifiers, devised by Prof. Robert H. Richards. Professor Richards has also installed an amalgamating table and a glass table with greased surface, such as are used in the South African diamond mines for separating special minerals.

Arrangements have been completed with the American Concentration Company, of Joplin, Mo., for a Knowles magnetic separator for quickly separating magnetic iron from black sands.

A rock crusher and an ore pulverizer are also installed.

With this equipment it is possible to treat a carload of sand in eight hours.

Methods of treatment.—Obviously the course of treatment to be used must vary greatly with the kind of sand to be treated.

The sands are grouped in two classes: (1) Sea sands, low-grade gravels, tailings from a number of dredges, and middlings from placer workings; and (2) heavy tailings from concentration containing the residue from the clean-up from placer mines, etc. The method of treatment so far developed for beach sands and tailings from placer mines has been to deliver the sand, after appropriate sampling, to the automatic feeder. It is then elevated to the roof of the building, passing over the Traylor screen, and delivered to an automatic distributer, from which it is evenly fed by a current of water through four iron pipes to the several concentrating machines. These machines separate the sands into three portions—concentrates, middlings, and tailings. All the concentrates and middlings are collected, and samples of the tailings taken every five minutes. Samples of these concentrates, middlings, and tailings are dried and then treated by the process devised by Mr. Henry E. Wood, of Denver, Colo., by which the sands are first separated by the magnetic separator by five successively increasing currents into six portions, representing the chief minerals contained in the sands. These are finally separated by a hand batea. The end products thus separated and obtained are magnetite, chromite, garnet, olivine, monazite, zircon, quartz, gold, and platinum. These minerals are then weighed, and the portions representing precious minerals are assayed.

ASSAY LABORATORY.

An assay laboratory has been installed and is now complete. This laboratory, which occupies a space of 20 by 20 feet in the mines building proper, which has been courteously supplied for this purpose by the Lewis and Clark Exposition Company, is in the immediate charge of Mr. Frederick W. Horton, of the Massachusetts Institute of Technology, chief assistant to Prof. Robert H. Richards, who directs the operation of the concentrating plant. Assisting Mr. Horton are Mr. G. H. Shadinger, of Johns Hopkins University, Baltimore; Mr. Amos Loveland, Mr. Northrop Dawson, Mr. F. H. Hazard, and Mr. L. G. Gillett, of Colorado Springs, Colo.

Here the following apparatus, partly lent and partly purchased of the F. W. Braun Company, of San Francisco, Cal., and of Messrs. Eimer & Amend, of New York City, has been installed: No. 40 Braun's combination crucible and cupelling furnace, with complete blowpipe apparatus and Cary hydrocarbon burner; the necessary crucibles, cupels, scorifiers, fluxes, etc., and weighing devices supplied by Eimer & Amend, of New York City, including very fine pulp and button balances. The last-named firm has also supplied a small electric furnace and electric hot plate. All the necessary chemicals and apparatus for making simple mineralogic determinations are found here.

In addition to being assayed, many specimens of concentrates from the various quantities of sands in process of treatment are run through a small glass classifier. This classifier, devised and made by Prof. Robert H. Richards, has 24 spigots and is capable of grading any material fed into it into as many different products, according to the settling power of each individual grain. The settling columns are of glass, thus allowing the operator to see just what is taking place in each column, and enabling him to regulate the machine with great precision. Samples of sand which, on

account of their small bulk, can not be concentrated to advantage on the concentrating tables are put through this classifier and finished by batea, and their values are thus successfully saved.

RESULTS.

The following results have been obtained by concentrating the black sand:

Forty pounds of black sand received from Placer, Josephine County, Oreg., yielded oversize on 10-mesh screen, 18 pounds, 9 ounces, which yielded 13.754 grams of gold nuggets. The undersize, through a 10-mesh screen, weighing 21 pounds, 5 ounces, yielded 11.6 grams of nugget gold. The total weight, 25.354 grams, would be worth, if pure, $16.84, giving a value per ton of $842.

Another interesting run of the black sands was from the residue from a clean up of dredging operations from Rockpoint, Oreg., which weighed 468.6 pounds, and contained quicksilver, amalgam, and gold. The oversize, through 10-mesh screen, was 223½ pounds and yielded 3.992 grams of gold; the undersize was 243 pounds and gave 15.270 grams of gold, making a total yield of nugget gold of 19.262 grams. This, if pure, would be worth $12.71, or the residues were worth $54.20 per ton.

Sea sand taken from near Fort Stevens, Oreg., at the mouth of the Columbia River, yielded the following results in pounds per ton of 2,000 pounds on one of the concentrating tables, supplemented by the magnetic machine and by panning the samples:

Results of concentrating sea sand from near Fort Stevens, Oreg.

[Pounds per short ton.]

Mineral obtained.	In the lot fed.	In the No. 1 concentrate.	In the No. 2 concentrate.	In the tailings.
Magnetite	683.0	572.0	44.6	66.79
Chromite and ilmenite[a]	163.0	150.0	9.44	3.06
Garnet	227.0	61.5	29.6	135.5
Monazite	.85	.36	.42	.07
Zircon	5.32	4.91	.01	.40
Quartz	288.0	.97	2.86	284.3
Other minerals[b]	483.0	5.71	5.71	471.7
Gold and platinum[c]				

[a] This product may prove by analysis to be mainly ilmenite.
[b] This product includes all the minerals that could not be separated into distinct groups.
[c] A satisfactory figure for publication has not yet been obtained.

SEPTEMBER 9, 1905.

EXHIBIT C.

SECOND PRELIMINARY REPORT ON INVESTIGATION OF BLACK SANDS.

Dr. David T. Day, of the United States Geological Survey, who has spent the past summer in investigating the black sands of the Pacific slope, has submitted to the Director of the Survey a second preliminary report on the progress of his work.

The first report contained an account of the minerals found in the various samples of sand.

The second report reviews the experiments in concentration that have been conducted at the Lewis and Clark Centennial Exposition at Portland, Oreg., with the view of ascertaining the most economical means of separating the useful minerals already enumerated in the first report of progress. Experiments have shown that the sands of the seashore and the sands from sluice boxes and placer mines have been arranged or classified by the action of the water. The size of each grain of sand is, therefore, inverse to its specific gravity—that is, the less its specific gravity the larger the grain of sand. It has also been shown that machines of the Wilfley type do very effective work in further separating these special mixtures of grains of sand. Two sharp conclusions have been established: (1) That 95 to 98 per cent of the precious metals, gold and platinum, are obtained in the first inch and a half on the surface of a Wilfley table; (2) that more than a ton of concentrates is obtained for every 100 tons of sand passed once over the table.

It should not be supposed that the enormous values per ton that are frequently shown in these results mean a new discovery of that much gold where it was not before suspected. This is not the case. Gold was known to be there, but no successful method of extracting it had been devised, and it normally went to waste.

Sands from the mouth of Columbia River furnished the material for the first experiments in concentration. The Astoria Chamber of Commerce requested an examination of these sands and cooperated to the extent of paying the cost of sacking the sands and putting them on cars. Mr. A. H. Gale, geologist, of the Survey, was accordingly dispatched to make a reconnoissance from the Oregon side, of all the different sands at the mouth of Columbia River. The condition of the beach sands found in this region was as follows:

The field investigated extends from Fort Stevens, at the mouth of Columbia River, southward 18 miles to Tillamook Head, a large mass of basaltic rock which juts out into the Pacific Ocean. On the east the sands are bounded by a clay ridge, which connects with Tillamook Head and extends gradually northeastward, reaching Columbia River at Astoria. This irregular ridge of clay slopes gently westward under the beach sands, so that from this ridge toward the ocean the clay soil becomes sandier, until a few hundred yards from the beach a series of high sand dunes, well covered with wood, are reached, and are succeeded farther west by the ordinary sands of the present beach. The region between the sand dunes and the clay region is known as Clatsop Plains. The area thus comprised in the triangle extending from Tillamook Head northeastward to Astoria, thence northwestward to Fort Stevens, and returning by the beach to Tillamook Head is divided into Clatsop Plains between the clay ridge to the east and the sand dunes on the western border, the sand dunes themselves, and the present broad, flat ocean beach.

In the region known as Clatsop Plains there is, as a rule, little variation in the sand, except that it increases in clay toward the east. The sand of the ocean beach, on the contrary, varies greatly in its characteristics. It is very black at the northern edge—that is, from Hammond station to Fort Stevens—and becomes lighter in color toward the south, being light gray at Nekanakum River. From Nekanakum River to Tillamook Head the sands become greenish, and within a mile of Tillamook Head the beach is very narrow and is composed largely of basaltic bowlders with little sand. At Moore's Hotel, about 1 mile from Tillamook Head, a carload sample was taken just above high-water mark, where the beach is about 300 feet wide and where it is made very green by the presence of olivine and other decomposed portions of the original basalt.

Minerals contained in concentrates from beach and river sands per ton.

	1.	2.	3.	4.	5.	6.	7.	8.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Magnetic iron ore	63.440	1.213	3.080	.9200	14.525	62.911	643.559	13.889
Ilmenite	47.720	.558	.701	.8389	2.581	24.543	171.392	3.367
Garnet	12.160	29.749	3.740	118.9351	3.658	30.458	174.478	131.308
Monazite	.108	.105	.012	1.3601	.096	.984	.800	.100
Zircon	.150	.008	.501	.1880	.130	.789	5.016	2.400
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Gold and platinum	9.1	43.4	.3	.06	1.3	6.0	53.0	2.4

1. From Moore's Hotel Seaside.
2. From Gearhart Beach.
3. From West station.
4. From Carnahan station.
5. From Warrenton station.
6. From point 150 feet north of Hammond railroad station.
7. From 1,500 feet west of Hammond railroad station at high-water mark.
8. From bottom of Columbia River at Pillar Rock.

A small sample was taken from Gearhart Beach, farther north, above high-water mark. A third sample was taken from a cut at the side of the railroad station near Carnahan station, a fourth at West station on the Astoria and Columbia River Railroad. A carload of sand was procured at Warrenton, another 150 feet north of Hammond railroad station, another 1,500 feet west of this station, on the line of the beach in the direction of Fort Stevens. Finally, for comparative purposes, a sample was taken from the bottom of Columbia River, beneath the swift-flowing current in the neighborhood of Pillar Rock. This sample was obtained in the course of the work of the dredge *William H. Ladd.* These samples were concentrated on four types of tables, those of Wilfley, Woodbury, Christensen, and Pinder. The minerals contained in the concentrates were then separated by a magnetic machine, which gave the results shown in the above table.

It became evident at an early stage of the concentration experiments that the sands could be separated very efficiently on concentrating tables, such as the well-known Wilfley concentrator or the Pinder concentrator, the Woodbury modification

of the Wilfley table, or the new type of concentrating table recently developed by Mr. Christensen and used for the first time in these experiments.

It is well known that the minerals most easily concentrated on such tables are those which have been first put through a hydraulic classifier, a device which has the effect of putting together large grains of light minerals and small grains of heavy minerals. It was found by examination of the sea sands under investigation that wave action had already classified them, as described above.

It was also found that the action of water currents in sluice boxes affected these sands in the same way, and the sands which sluice boxes had failed to separate were best suited for separation on the concentrating tables. This investigation has therefore shown that sands which can not be separated in sluice boxes can be separated by mechanical devices more easily than can ordinary gravels. From 95 to 98 per cent of the gold and platinum contained in the black sands are concentrated within a space of an inch and a half, or less, on the upper edge of the concentrating table.

Such results had also been obtained in work along the same direction by Mr. Henry E. Wood, of Denver. These results in concentration have been applied in the examination of the beach sands on the Oregon side of the mouth of Columbia River.

A lot of one-half ton of the sand from the beach about one mile due west of Carnahan station was fed to three of the concentrating tables and divided into concentrates and tails. The original concentrates obtained were run over the tables again and reconcentrated. The first 1½ inches of the material as spread out on the table were divided off as No. 1 concentrates. The next 3 or 4 inches were taken as No. 2 concentrates, and the remainder went as tailings. The concentration of the gold and platinum thus effected is shown by the following assays. The original sand as fed to the table assayed 6 cents per ton. The No. 1 concentrates assayed $6.14 per ton, showing the ratio of concentration of gold and platinum values compared to the original sand of 102 to 1. The No. 2 concentrates assayed 52 cents per ton, with a ratio of concentration compared to the original sand of 9 to 1. Another sample from the same neighborhood showed the following concentration results:

Concentration of gold effected by mechanical tables on sand from the Pacific beach.

Material.	I.			II.		
	Weight.	Assay per ton.	Ratio of value.	Weight.	Assay per ton.	Ratio of value.
	Pounds.			*Pounds.*		
Original feed	4,089.00	$0.21	1.00	3,690.0	$0.003	1
Rerun feed	.....	.....	.....	92.0	.120	40
Rerun No. 1 concentrates	7.25	14.55	69.30	1.0	8.040	2,647
Rerun No. 2 concentrates	202.75	1.74	8.30	4.5	.397	132
Rerun No. 3 concentrates	.....	.....	.....	5.5	.085	28
Rerun tailings	None.	.....	.....	81.0	Trace.	.....
Original tailings	3,879.00	.08	.38	3,598.0	Trace.	.....

The sample marked "II" was taken from a railroad cut 30 feet deep, which is situated 1,000 feet north of West station, at the mouth of Columbia River. This sample was taken from the first 10 feet in depth and is of particular interest, as it shows the remarkable concentration of value which may be effected by rerunning or reconcentrating original concentrates. In this case the original feed to the concentrating tables weighed 3,690 pounds and assayed $0.003 per ton. This was first divided by the tables into 92 pounds of original concentrates and 3,598 pounds of original tailings. These tailings were practically free from gold, as may be seen from the accompanying table.

The original concentrate (rerun feed) was next reconcentrated on one of the tables and divided into four products—Nos. 1, 2, and 3 concentrates and the tailings. While the original concentrates were only 40 times as rich as the original sand, the rerun concentrates were 2,647 times as rich and, although only 1 pound in weight, these contained two-thirds of the gold which went onto the table. The No. 2 rerun concentrates were 132 times as rich as the original sand and, weighing 4.5 pounds, contained practically all the remaining gold. This means that practically all the gold contained in 3,690 pounds of sand was concentrated in 5.5 pounds, and of these 5.5 1 pound contained two-thirds the gold. This remarkable concentration certainly speaks well for the recovery of gold and platinum values in sand by means of concentrating tables.

Sand from a bar in Columbia River near mouth of Hood River, Wasco County, Oreg.

Material.	Serial number, P122a.			Serial number, P122b.		Serial number, P122c.		
	Weight.	Assay per ton.	Ratio of value.	Weight.	Assay per ton.	Weight.	Assay per ton.	Ratio of value.
	Pounds.			*Pounds.*		*Pounds.*		
Feed of original sand..	1,296.0	$0.320	1.00	888.0	Trace of gold.	2,168.0	$0.018	1.00
Concentrates No. 1.....	7.0	21.850	68.30	2.5	$0.380	25.5	.302	16.80
Concentrates No. 2.....	45.0	.060	.19	34.0	Trace of gold.	216.0	.....	.....
Tailings.....	1,244.0	.054	.17	851.5	Trace of gold.	1,930.5	.015	.83

Concentration results with heavy concentrates from hydraulic mine at Galice, Josephine County, Oreg.

SERIAL NUMBER, P129A.

[Weight of original sample, 195.5 pounds.]

	Weight.	Assay per ton.
	Pounds.	
Coarser than $\frac{1}{2}$ mm.....	119.5	$30.38
Concentrates No. 1.....	18.5	[a]207.61
Concentrates No. 2.....	98.0	(*b*)
Tailings.....	3.0	.....
Through $\frac{1}{2}$ mm.....	76.0	7.84
Concentrates No. 1.....	5.5	[c]99.22
Concentrates No. 2.....	45.8	.078

SERIAL NUMBER, P129B.

[Weight of original sample, 352 pounds.]

Coarser than 2 mm. screen.....	50.5	344.36
Concentrates No. 1.....	14.0	888.40
Concentrates No. 2.....	26.5	.15
Tailings.....	6.0	1.82
Through 2 mm. screen.....	228.0	215.69
Concentrates No 1—		
Magnetic	57.0	199.26
Nonmagnetic	5.5	7,611.60
Concentrates No. 2.....	23.5	8.41
Tailings.....	142.0	2.48
Through $\frac{1}{2}$ mm	73.5	98.39
Concentrates No. 1.....	21.0	385.00
Concentrates No. 2.....	40.5	1.31
Tailings.....	12.0	41.34

[a] 13.5 pounds of concentrates, worth $207.61 per ton, are equivalent to $32.14 per ton on the original material fed, with greater yield than is shown by the original assay.

[b] Trace of gold.

[c] This concentration is equivalent to obtaining in the 5.5 pounds of first concentrates $7.18 per ton out of the total of $7.84 per ton contained in the material fed to the table, or is equivalent to obtaining 0.92 per cent of the total gold in the sample in the 5.5 pounds of No. 1 concentrates.

Composition, per ton, of heavy black-sand concentrates from placer mine at Ashland, Jackson County, Oreg.

[Serial number, P13.]

	Pounds.
Magnetite	1,181.00
Chromite	2.00
Garnet	370.00
Monazite	34.00
Zircon	66.00
Quartz	344.00
Gold and platinum	$0.15

Composition, per ton, of heavy black-sand concentrates from Jacksonville, Jackson County, Oreg.

[Serial number, P19.]

	Pounds.
Magnetite	1,463.00
Garnet	Trace.
Monazite	
Zircon	4.14
Ilmenite and chromite	296.60
Gold and platinum	$74.00

Composition, per ton, of heavy concentrates from Toronto, Canada.

[Serial number, P21.]

	Pounds.
Magnetite	561.00
Chrome iron ore	218.00
Garnet	818.00
Monazite	13.00
Zircon	21.00
Gold and platinum	$230.78

Composition, per ton, of concentrated black sand from Meadows, Washington County, Idaho.

[Serial number, P25.]

	Pounds.
Magnetite	629.40
Chromite	564.10
Monazite	123.80
Zircon	392.50
Quartz	232.50
Garnet	Trace.
Gold and platinum	$9.64

Composition, per ton, of concentrates from Gearhart Beach, Clatsop County, Oreg.

[Serial number, P26.]

	Pounds.
Magnetite	1.00
Garnet	29.00
Gold and platinum	$0.434

The greater part of the sand consisted of olivine, quartz, and mixed grains of various minerals.

Composition, per ton, of heavy sand remaining after clean-up of concentrates from deep mining at Marysville, Yuba County, Cal.

[Serial number, P27.]

	Pounds.
Magnetite	562.00
Chromite and ilmenite	122.00
Garnet	10.70
Olivine	176.00
Monazite	Trace.
Zircon	3.00
Quartz	714.00
Gold and platinum	$0.97

Composition, per ton, of concentrates from Hood River Beach, Wasco County, Oreg.

[Serial number, P28.]

	Pounds.
Magnetite	995.00
Chrome iron and ilmenite	174.50
Garnet	221.00
Olivine	287.00
Monazite	5.00
Zircon	16.50

Composition, per ton, of concentrates from Arnett Creek and Camp Creek, Leesburg Basin, Idaho.

[Serial number, P31.]

	Pounds.
Sample A, from Arnett Creek:	
Magnetite	959.60
Chromite	832.80
Garnet	116.80
Monazite	.45
Zircon	1.55
Gold	$86.81
Sample B, from Camp Creek:	
Magnetite	1,290.00
Chromite	474.20
Garnet	55.99
Olivine	14.00
Zircon	.60
Gold	Trace.
Sample C, from Ward's Gulch:	
Magnetite	747.90
Chromite	859.00
Garnet	128.70
Monazite	5.54
Zircon	60.89
Quartz	73.00
Gold	$43.54
Sample D, from Richardson Brothers:	
Magnetite	433.20
Chromite	477.20
Monazite	10.89
Quartz	65.33
Gold	$2.69
Sample E, from placer diggings:	
Magnetite	1,939.00
Chromite	.91
Garnet	4.20
Monazite	.50
Zircon	.86
Quartz	8.00

Composition, per ton of black sand from Clatsop Beach, Oregon.

[Serial number, P32.]

	Pounds.
Magnetite	537.50
Chromite	43.50
Garnet	137.00
Monazite	.43
Zircon	.61
Quartz	54.80

Composition, per ton, of concentrates from hydraulic mining in Sutter Creek, Josephine County, Oreg.

[Serial number, P34.]

	Pounds.
Magnetite	1,146.00
Chrome iron and ilmenite	673.00
Zircon	24.69
Quartz	11.50
Gold and platinum	$275.91

Composition, per ton, of black sand from Carson City, Ormsby County, Nev.

[Serial number, P35.]

	Pounds.
Magnetite	1,387.00
Garnet	41.90
Chromite	485.60
Monazite	29.47
Zircon	21.32
Quartz	9.08
Gold	$7.44

Composition, per ton, of black sand from Boise, Ada County, Idaho.

[Serial number, P36.]

	Pounds.
Magnetite	26.40
Chromite	200.80
Garnet	709.10
Monazite	219.60
Zircon	231.40
Quartz	579.40
Gold	$1.03

Composition, per ton, of black sand from Wallowa, Wallowa County, Oreg.

[Serial number, P37.]

	Pounds.
Magnetite	59.00
Chromite	9.30
Garnet	175.00
Monazite	.67
Pyrite	610.60
Quartz	630.50
Gold	$2.25

Composition, per ton, of black sand from Gold Beach, Curry County, Cal.

[Serial number, P46.]

	Pounds.
Magnetite	584.60
Chrome iron and ilmenite	82.00
Garnet	206.00
Monazite	.50
Zircon	5.00
Quartz	500.00
Gold	$0.783

Concentration of above sample.

	Weight.	Assay value per ton.
	Pounds.	
Original material	107	$0.78
Concentrates No. 1	30	2.66
Concentrates No. 2	.....	.04
Tailings	.....	.04

Composition, per ton, of black sand from Shoshone, Lincoln County, Idaho.

[Serial number, P40.]

	Pounds.
Magnetite	174.80
Chromite	15.17
Garnet	80.67
Monazite	26.34
Zircon	46.09
Quartz	1,441.00
Gold	$26.33

Composition, per ton, of black sand from Seattle, King County, Wash.

[Serial number, P60.]

	Pounds.
Magnetite	10.82
Chromite	.28
Garnet	9.26
Monazite	1.18
Zircon	1.48
Quartz	1,635.00
Gold	$0.31

Composition, per ton, of black sand from Portland, Multnomah County, Oreg.

[Serial number, P61a–b.]

	Pounds.
Sample A:	
Magnetite	10.95
Chromite	50.78
Garnet	15.43
Monazite	.43
Zircon	12.42
Quartz	1,757.00
Gold and platinum	
Sample B:	
Magnetite	3.89
Chromite	31.46
Quartz	1,864.00
Gold and platinum	$0.11

It has become evident, in the course of this investigation, that gold so fine that it will pass through a sieve of 150 meshes to the inch can be saved with great ease on the tables.

Exhibit D.

PROPERTY CONNECTED WITH BLACK-SAND PLANT.

1 Wetherill magnetic separator, type E.
1 Wilfley concentrator, laboratory type.
1 revolving drier, capacity 20 tons.
Ore bins, capacity 50 tons.
Settling tanks, capacity 100 tons.
Panning tank, platform scales.
8 mm., 2 mm., and ½ mm. mechanical screens, capacity 10 tons per day.
Electric steel smelting furnace, complete.
25 extra carbon electrodes for furnace.
Automatic pipe distributing apparatus to all machines on pavilion, capacity 60 tons per day.
1 hydraulic classifier of 24 tubes, type A, capacity 500 pounds per day.
1 hydraulic classifier, type B, capacity 20 tons.
1 hydraulic classifier, type C, capacity 50 tons per day.

1 set amalgamating plates.
1 set Gem-separating plates, South African type.
1 Nevada mill.
1 power-jaw crusher.
1 mechanical truck for distributing samples, capacity ½ ton.
2 wheelbarrows.
2 blowpipe outfits.
32 iron buckets.
1 gasoline burner for assay furnace.
1 Cory assay furnace, complete.
3 sets of screens, from 20 to 200 mesh.
7 evaporating dishes.
1 pair forceps.
1 funnel.
5 hammers.
3 alcohol lamps.
1 mortar and pestle.
1 pouring mold.
68 pans.
13 shovels and rake.
1 set rules and other drawing appliances.
Scales for fine assaying.
Trip scales.
7 brass appliances for magnetic separator.
Iron stands, rings, and clamps, and other laboratory apparatus.
6 magnifying glasses.
1 microscope, complete.
1 set weights.
Shafting, pulleys, and belts for connecting up the concentrating machines.
Office furniture:
6 desks.
4 sets bookshelves.
7 laboratory tables.
Electric-lighting fixtures.
Dark room for special work.
2,000 running feet shelving.
15 chairs.
Card catalogue cabinets and file cabinets.
2,000 glass jars.
2,000 scorifiers.
1,000 cupels.
200 fire-clay crucibles.
6,000 100-pound ore sacks.
2,000 10-pound canvas sacks.

Loaned.

1 Pinder concentrator, capacity 15 tons per day.
1 Christonsen concentrator, capacity 30 tons per day.
1 Wilfley concentrator, capacity 15 tons per day.
1 set Traylor's automatic screens, capacity 60 tons per day.
1 Hendy automatic elevator, capacity 100 tons per day.
1 Hendy Challenge automatic ore feeder, capacity 100 tons per day.
1 Knowles New Century magnetic separator, capacity 2 tons.
10 dynamos, various sizes, for operating all machinery.
Electric wiring, water piping, and water supply for all concentrating machines.
Water supply and plumbing for chemical laboratory.

Exhibit E.

Distribution of expenses of black sand investigation.

Field work	$5,200.00
Concentrating experiments	13,021.16
Assaying	2,600.00
Chemical analyses	800.00
Determination of minerals	600.00
Electric smelting	1,400.00
Computations	1,600.00
Office correspondence	2,200.00
Total	27,421.16

Expenses of black sand investigation, March 3, 1905, to November 30, 1905 (part of November an estimate).

Quarter ending—	Supplies.	Pay.	Machinery.	Power.	Traveling expenses.	Telegraph and telephone.	Expressage and freight.	Total.
March 31, 1905	.....	.....	.....	.....	$215.42	.....	.....	$215.42
June 30, 1905	$74.39	$585.00	.....	.....	286.75	$4.40	.....	950.54
September 30, 1905	1,468.57	4,335.97	$696.97	.....	2,594.74	3.25	$249.20	9,348.70
Unfinished quarter to November 30, 1905	2,888.19	8,372.27	1,350.26	$92.00	3,569.37	7.94	626.47	16,906.50
Total	4,431.15	13,293.24	2,047.23	92.00	6,666.28	15.59	875.67	27,421.16

59TH CONGRESS, 1st Session. } HOUSE OF REPRESENTATIVES. { REPORT No. 7.

BLACK SANDS OF THE PACIFIC SLOPE.

DECEMBER 18, 1905.—Referred to the House Calendar and ordered to be printed.

Mr. BROWN, from the Committee on Mines and Mining, submitted the following

REPORT.

[To accompany H. Res. No. 73.]

The Committee on Mines and Mining of the House of Representatives having had under consideration House resolution No. 73 report the same back with recommendation that it do pass.

The resolution requests the Secretary of the Interior "to furnish Congress a report on the progress of the investigation of the black sands of the Pacific slope, authority for which was included in that section of the sundry civil act approved March 3, 1905, which provided for the preparation of the report on the mineral resources of the United States, and for his opinion as to whether or not this investigation should be continued."

The Government has been carrying on under an appropriation made by the last Congress an investigation of the black sands of the United States with a view to discovering what valuable minerals were contained in these sands and whether their economical separation was practicable, etc. In carrying on this investigation a plant was established at Portland, Oreg. Manufacturers of mining machinery contributed most of the necessary machinery, and work was continued until the exhaustion of the fund quite recently. The plant is still located at Portland, in good order, and there is at this time some 80 tons, consisting of about 600 samples of these sands, now at the plant awaiting treatment.

In this condition of affairs, particularly in view of the fact that the reports which have been made in this investigation seem to indicate that the black sands of many parts of the country carry considerable quantities of platinum, zircon, columbite, and chrome iron, garnet, and other minerals of value, and that these minerals can be cheaply separated, it is deemed best to call upon the Secretary of the Interior for a report as to the progress already made in this work and his opinion as to whether or not the investigation should be continued.